Rutgers University, Department of Electrical and Computer Engineering
ABET COURSE SYLLABUS
COURSE: 14:332:331

Course Catalog Description: 14:332:331 - Computer Architecture and Assembly Language (3) History and principles of computer architecture. Computer organization, Assembly language and machine code, computer arithmetic, ALU design, computer performance, datapath and control, pipelining, memory hierarchy, I/O devices, multi-processor and distributed architectures, graphics, mobile and multi-core processors.

Pre-Requisite Courses: 14:332:231 (Digital Logic Design).

Co-Requisite Courses: 14:332:333 Computer Architecture Lab.

Pre-Requisite by Topic:
1. Basic logic and state machine design;
2. Programming fundamentals such as data structures, algorithms, and subroutines;
3. Number systems.

Textbook & Materials: Patterson, David A. and Hennessy, John L., *Computer Organization & Design*, Revised Fourth Edition, Morgan Kaufmann Publishers, 2011, ISBN 978-0-12-374750-1, class notes.

References: *The book CD and added readings*

Overall Educational Objective: To develop skills in understanding and evaluating the organization, operation and programming of current microprocessors and their peripherals, as well as to develop skills in designing basic processor components.

Course Learning Outcomes: A student who successfully fulfills the course requirements will have demonstrated:

1. an ability to define and explain the principles of computer architecture and the interfacing between its hardware and software components;
2. an ability to write assembly programs (including recursive procedures) and understand its machine code equivalent;
3. an in-depth understanding of architectural blocks involved in computer arithmetic, both integer and floating point;
4. an in-depth understanding of the datapath inside a processor, its control, and handling of exceptions;
5. an in-depth understanding of pipelining for 32-bit architectures, pipeline hazards, and ways of fixing hazards;
6. an ability to understand and analyze computer memory hierarchy, at all levels of its organization, especially the interaction between caches and main memory;
7. an ability to understand computer busses and input/output peripherals;
8. an ability to understand multi-processor and distributed architectures.

How Course Outcomes are Assessed:

Pre-requisite Quiz:	2%
Homework and quizzes:	38%
Midterm 1:	30%
Final Exam:	30%

N = none S = Supportive H = highly related

Outcome	Level	Proficiency assessed by
(a) an ability to apply knowledge of Mathematics, science, and engineering	H	HW Problems, Exams
(b) an ability to design and conduct experiments and interpret data	S	Design Problems in HW and Exams
(c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	N	
(d) an ability to function as part of a multi-disciplinary team	N	
(e) an ability to identify, formulate, and solve ECE problems	H	HW Problems, Exams
(f) an understanding of professional and ethical responsibility	N	
(g) an ability to communicate in written and oral form	S	HW Problems and Exams
(h) the broad education necessary to understand the impact of electrical and computer engineering solutions in a global, economic, environmental, and societal context	N	
(i) a recognition of the need for, and an ability to engage in life-long learning	S	Homework, discussions during lectures
(j) a knowledge of contemporary issues	N	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for electrical and computer engineering practice	H	HW Problems, Exams
Basic disciplines in Electrical Engineering	H	HW Problems, Exams
Depth in Electrical Engineering	S	HW Problems, Exams
Basic disciplines in Computer Engineering	H	HW Problems, Exams
Depth in Computer Engineering	H	HW Problems, Exams
Laboratory equipment and software tools	S	HW Problems, Mid-Term Exam
Variety of instruction formats	S	Lecture, office hour discussions

Topics Covered week by week:

Week 1: Introduction, history of computers, relation between hardware and software components of computer architecture
Week 2: DLD quiz, Assembly language instructions
Week 3: Assembly language instructions
Week 4: Assembly language instructions
Week 5: Computer Arithmetic
Week 6: Computer Arithmetic
Week 7: Computer Arithmetic and Midterm
Week 8: Processor (Datapath and its control)
Week 9: Processor (Datapath and its control)
Week 10: Processor (Datapath and its control
Week 11: Memory hierarchy
Week 12: Memory hierarchy
Week 13: Input/Output devices and busses
Week 14: Input/Output devices, Multi-core, clusters
Week 15: Multi-core, clusters and Final

Computer Usage: Students use the computer as part of the co-requisite lab course.

Laboratory Experiences: It is a separate course 14:332:333 associated with this course.

Design Experiences: HW problems and exams in designing circuits.

Independent Learning Experiences: NA

Contribution to the Professional Component:

(a) College-level mathematics and basic sciences: 0.25 credit hours
(b) Engineering Topics (Science and/or Design): 2.75 credit hours
(c) General Education: 0 credit hours
Total credits: 3

Prepared by: Professor G. Burdea
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